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CONCERNS FOR BIRDLIFE
DURING OIL AND GAS DEVELOPMENT

BY
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Birds found in the Beaufort Sea region converge from wintering grounds in the Pacific and Antarctic Oceans and in North and South America. That is about one-third of the globe surface. Of the birds nesting on the Coast of the Beaufort Sea and the Arctic Islands, approximately two-thirds migrate through the Great Plains and the Mackenzie Valley, while the rest travel through the Bering Straits and follow the coast of Alaska, Yukon and the Northwest Territories.

Water birds moving along the narrow leads, which usually form between the shore-fast ice and the Arctic pack in May and June, can become extremely concentrated under certain conditions. Species using the Arctic coast migration route include Arctic Terns, Sabines Gulls, Jaegers, from the Antarctic and South Pacific. Pacific Brant from coastal Mexico and California, and Eiders, Murres and Glaucous Gulls from the North Pacific and Bering Sea. Some species flying the interior migration routes also use the coast, especially the Whistling Swans move westward in the spring from the Mackenzie Delta and travel along the Yukon and Alaskan coasts. Many Snow geese follow the coast of Tukotyaktuk Peninsula when enroute from the Mackenzie Delta to Banks Island and they use the same route again in the fall.

The Beaufort Sea is very shallow near the coast. The ten-fathom contour is about 20 to 25 miles offshore. Tidal changes are only between 1 and 2 feet, but onshore winds often cause storm tides of up to 8 feet during the ice-free periods. The Polar Ice Pack may completely cover the Beaufort Sea in any season.

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Typically, however, an ice-free margin extending from 3 to 100 or more miles offshore exists at least intermittently between early July and late September.

The discoveries of oil and gas along the rim of the Beaufort Sea and the prospective offshore drilling has shown the need for more reliable information about the marine avifauna. In the past, population estimates of Beaufort Sea birds were from casual surveys conducted as part of other studies or reconnaissances. From work done in the past several years, we estimate that there are approximately 2,000,000 migratory birds that frequent the Beaufort Sea and the littoral zone (by littoral zone, I mean the area up to the highest of storm tides). There are several species of water birds, for which, the shores and marshes are the principal nesting grounds. For large numbers of seabirds the coastal bays, the lagoons, barrier beaches and islands are important as nesting and molting grounds. For seabirds migrating along the coast, the open water leads in the sea ice are the traditional places for resting and feeding. Open water leads form along the Coast and allow a migrating route, which the birds follow. To reduce the risk of contaminating these birds by oil spills and blowouts, it is important to know the critical times and places for the birds found in the Beaufort Sea. Such information about the avifauna makes possible the timing and location of drilling and support activities in order to minimize the danger.

The data presented here concerning the spatial and temporal distribution of birds in the Beaufort Sea results from three different methods of doing surveys: ground surveys, aerial surveys, and more

recently, radar observations. However, it is difficult to estimate the numbers of migratory birds because of difficulties of weather conditions, difficulties of visibility and an ever-changing, mobile population in such a large area as the Beaufort Sea. Nevertheless it might be useful to make a few estimates of some of the more important birds. There are at least three species of loons that are normally seen in the Beaufort Sea and our estimate is that approximately 35,000 of these birds will pass through the Beaufort Sea at any one time. There are three different species of jaegers that migrate along the Beaufort Sea. Our estimate is 21,000. The largest gull in the area, - glaucous gull - we estimate about 35,000 passing through the area. Of the old squaw duck, a very common bird in the Arctic, approximately 1,130,000 are estimated to migrate through the Beaufort Sea area. There are two species of eider ducks, the common eider and the king eider. Together, we estimate about 1,100,000 are found in the Beaufort Sea area. Whitefronted geese use mostly the coastal areas on the mainland, approximately 25,000 are estimated to occur in the Liverpool Bay area. There are at least 200,000 snowgeese nesting on Banks Island and many of them follow the shores at Tuk Peninsula enroute to Banks Island. There are approximately 25,000 to 30,000 Pacific Brant migrating along the coasts of the Beaufort Sea, also there are uncounted thousands of shore birds: plovers, turnstones, sandpipers, etc.

During our ground aerial and radar surveys conducted in the years 1972 through 1975, we covered

the coastal lagoons and the shorelines and out to sea, as far as 200 miles, wo we have coverage of the southern part of the Beaufort Sea. This was designed to cover the area which is under Federal Government Oil leases for exploration and development at this time.

As a result of all these surveys, to summarize it very briefly, we found that as far as birdlife are concerned, there are sensitive areas and times for their occurrence in the Beaufort Sea. The most important are the ice leads, those areas of open water that form between the shorefact ice and the Arctic pack in the early spring. The leads are a migration route and for some species like the eider ducks and old squaws and loons, as they must have a place to stop, either to rest or to feed during their migrations. During the fall migration, the ice has retreated to the north. There are large open areas of water. The ice leads are the important only during the spring migration, which occures from about the first of May to early July.

The aspect that makes the ice lead so sensitive is the fact that a sea bird may be flying for literally hundreds of miles over ice before it finds anything that looks like open water. There are traditional places like off Cape Dalhousie where almost invariably there is some open water in early spring. The birds will concentrate there because it is the only place to land. We have found in our flights that as many as 75,000 to 100,000 eider ducks and other diving birds can be concentrated there at any one time. This is a transient population that might be there one day and could be replaced by another large group a day or a week hence, as the birds

continue moving on to their nesting grounds. The attractiveness of the first open water to appear in the spring can be demonstrated by a photograph which I will pass around. This photograph was taken a few years ago. (Oil spills are not new to the Arctic). The photo was taken during the spring of 1957 or 1958 at Norman Wells. There was an oil spill on top of the ice early in the year. It looked like water to the first arriving ducks and geese and therefore was the place for them to land. The attractiveness of open-water to first-arriving birds is true, not only along the coast but also along the Mackenzie River in the pre-breakup stage. You will note that this picture - it looks like water - but it is a large pool of oil in which - in the course of a few days - over 400 migrating geese, swans and ducks were trapped. The second photograph shows the condition of these birds. They were of course completely wiped out. So this is one sensitive and important area: first-appearing open water in the spring - in this case the leads of open water along the Arctic Coast.

The other sensitive areas for migratory birds in the Beaufort Sea are the coastal lagoons, the bays and barrier beaches and the tidal marshes from June through late September, even into October and freezeup. The barrier beaches and the coastal areas and the tidal marshes are important for several reasons. It is the rearing area for birds that nest either on the marshes or on the peripnery of these areas. The young are frequently taken to the water where they feed and develop. It is also a moulting ground - all ducks, geese and swans - in the summer - usually shortly after the young

have hatched - moult all their flight feathers. Large flocks, for protection, get into these bays and lagoons and become flightless for a period of 30 to 45 days, depending on the species. These birds are absolutely helpless. They are unable to fly and any oil spill or contamination of these barrier beaches and the coastal area will result in the destruction of whole flocks. Later on in the fall, from late August through September, the coastal marshes and the barrier beaches are staging areas. For instance, snowgeese from Banks Island will migrate from Banks Island to the mainland coast, where the season is a bit more delayed and they are able to feed and gain body weight and strength of flight in preparation for the long migration south. These fall staging areas, especially the outer part of the Mackenzie Delta, and along the north coast of the Yukon and the Tuk Peninsula are important to snow geese, whitefronted geese, brant, and many other of the ducks.

There are about 100 different species of birds which use the Beaufort Sea or its littoral zone sometime during any particular season. It is impossible to generalize about any one of them and their propensity for being involved in an oil spill, or coastal pollution. It would be confusing to try to go through the life histories of all of these different species. I think the best way would be to take several representative species of some of the more economically important species and trace their occurrence in the Beaufort Sea at any particular season and try to pinpoint areas where there are liable to be critical situations with oil spills or unusual disturbances.

Probably the most valuable species in the Mackenzie Delta and Beaufort Sea region is the lesser snow goose. Snow geese arrive in the spring by way of the Mackenzie Valley, stopping at various places, especially along the river where the first open water occurs. I mentioned earlier - the photograph of Norman Wells - this is one of the areas where if there appears to be open water, the geese will stop. They move north through the latter part of May and to the outer part of the Mackenzie Delta. Many follow the main channel of the Mackenzie, and then to Kitigazuit and along the Tuk peninsula to Banks Island. In this area snow geese are an important species, a food source - for the residents of Tuktoyaktuk. They arrive at Banks Island in the latter part of May. They usually begin nesting by the first of June. Approximately 200,000 snow geese nest on Banks Island. The nesting grounds are inland from the coast, but there are two subcolonies: one at the Anderson river delta and the other at the Kendall Island area in the central part of the Mackenzie Delta. Both of these areas are low and are subjected to spring floods to a degree, but in the fall are subjected to storm tides. The storm tides in the fall could carry oil well onto the flats. As we mentioned before, storm tides of 6 to 8 or more feet, depending on the degree of wind.

After the young snowgeese hatch, they disburse, on foot and moult on the various river islands of both the Anderson River, Kendall Island area and on Banks Island. When the young are approximately four weeks old and are able to fly, they begin to accumulate into flocks ready for migration to the staging areas. The fall staging areas for snowgeese - are the Mackenzie Delta westward into Alaska, although in some years the Bathurst Peninsula

is used. The geese are grazing birds, feeding to a large extent, on the grasses and sedges of the low flats of the Mackenzie Delta, although they also do go upland into the north slope of the Yukon and Alaska. This particular area in the fall is very sensitive. A storm tide could carry any large spill onto the land. If geese are disturbed in this area to any great degree, they will probably be not able to put on enough weight and strength in the short season they have there to make the rest of their fall migration successful.

Another species representative of the Beaufort Sea, are eiders; the king and the common eider. They winter in the Bering Sea in the North Pacific and in early spring, especially the males first, follow the ice leads around the coast of Alaska and along through the Beaufort Sea to mesting grounds, located in the Arctic Islands and along the coast east as far as Queen Maud Gulf. The migration route is a traditional one that follows the open leads that are expected to be found along the coast. These leads are present more years than they are not; but on occasion, in 1964 for example, strong onshore winds prevented these leads from opening up. We found eider ducks scattered along the coast all the way from Prince Patrick Island, Holman Island, Sachs Harbour, the complete Tuk Peninsula and all the way to Point Barrow in Alaska. This was an unusual situation in which no open water was available until the end of June, after migration was over. We estimate, approximately 100,000 eider ducks died of starvation as a result of the leads not opening up. Now, it might be safe to assume that if the leads were open, or if there was anything that looked like open water, the eiders would land in it. In fact there was a small

piece of open water in the fingers of Eskimo Lakes, near Saunatuk, which is not on the normal migration route but in that particular year it was just covered with eider ducks - 10,000 or 15,000 birds were jammed into the small piece of open water. Now let's assume that an oil spill had occurred on the ice and it would look to an eider duck just like the only open water for hundreds and hundreds of miles. You may be sure because the offshore drilling locations are practically on the fringes of the migration route that literally thousands of birds would come to that "open water" as a spot to feed and rest. This is an extremely sensitive area. It would affect not only the eider ducks but also oil-squaw ducks and loons and quite a few other species.

The critical period for eiders would be from about the 25th of April until the end of their migration to the eastward which terminates around the latter part of June. But that's not the end. The male eiders, as soon as the female has started nesting migrate back west to the northern Chucksi Sea, by early July where they gatner to go through their annual moult. Throughout the season there is a continual migration of eiders, either east or west, up until freezeup in October. The open leads would be put in danger if it were contaminated in any way. Over a million birds, especially the eiders, but also old squaws, squaps and scoters occur along that area.

The eider ducks primarily feed on the bottom of the ocean. They dive to a considerable depth. It is probably why the shallower open water found

off Cape Dalhousie is one of the main concentration points for eiders. We are not very sure of their food habits, although they are known to take clams and probably marine isopods and things of that sort. What undersea contamination might do to the food chain of this particular species, we are not aware at this time.

Another area and a species to consider as a typical sea bird are the murres. The murres nest on cliffs in very large colonies. In the Beaufort Sea area, there is only one colony of murres and it is relatively small. It is located at the very tip of Cape Parry near the Parry DEWline site. There is a small cliff with the necessary combination of an early opening in the water in the areas around the bottom of the cliff. The murre is entirely a marine feeder and the colony at Cape Parry is unique in that there are no other murre colonies for a thousand miles to the east, north of Summerset Island. To the westward, the nearest murre colony is also approximately 1500 miles to the west in the Bering Sea. So we have a unique group of birds that are completely controlled by the sea. They feed on the open waters. We are not sure of the taxonomy of this particular group of murres, although we assume they are related to the Pacific birds rather than the Atlantic birds. Their food habits are largely unknown although murres normally feed on small capelin and other small marine fishes. The murres also use the ice leads stopping points in their migration and of course need open water near the base of their nesting cliffs.

There is in the literature, considerable amount of study on the cleanup of birds, once they are oiled. Oil matts the feathers on the birds and destroys the down insulation. The bird is immediately subjected to the cold waters, and dies of hypothermia. It is possible to remove oil with detergents, but in every case, although the birds may survive briefly after being cleaned, they invariably die. Even in warmer climates such as in the Santa Barbara oilspill in Calformia, attempts to clean birds and rehabilitate them turned out to be unsuccessful. Some birds, were returned to the water, but a close follow-up found that virtually all of them died within a week or two after they had gone through the cleaning process.

In the Arctic, with its difficult logistics and perhaps bad ice conditions when one would expect to have trouble with oil spills, I am extremely pessimistic about any attempts to salvage or rehabilitate any bird that got into an oil spill. With the cohtinual turnover of birds in the migration period, one could expect very, very high mortalities, as long as the spill is there. How quickly a spill could be cleaned up is something that I do not know; and I don't think the proponents have been able to come up with a satisfactory answer on how quickly oil could be cleaned up or disbursed.

Along the coastal lagoons of the shores of Beaufort Sea, a group of waterfowl, scoters, (locally called black ducks) scaup and old squaws -- gather to moult. They arrive in the coastal

lagoons in the middle of July to moult. The males come to these areas from inland nesting grounds. They are joined by old squaw ducks, both breeders and non-breeders, primarily male birds and younger females that don't nest. They are flightless for a period from the 15th of July until almost the end of August. Around the Tuk peninsula approximately 600,000 of these ducks flightless along the various lagoons and barrier beaches. The Tuk Peninsula is not used for moulting every year. In some years there are very large numbers occurring in Northern Alaska. They are completely helpless during this flightless period. Their only means of escape is to dive and swim from one spot to another. They feed on the various marine fishes and marine invertebrates that are found in the protection of barrier beaches and lagoons. Any oil spill that had washed ashore or over the barrier beaches and into the lagoons, would cause very serious damage to this population of waterfowl.

In the plans for offshore drilling, the two sites that Dome Petroleum has in mind, are located near the edge of the shear zone, the boundary between the land fast ice and the drifting pack ice. This is on the migration route. The logistics of getting to an oil spill when there is moving ice and how they will drill a relief hole if there is a blowout are all contained in scenarios of what happen should a blowout occur. I understand, these will be presented at this inquiry by other people who are more familiar with the ice movements and the currents along the coast. Needless to say, one can

expect birds to be found any place with open water during the period from the first of May approximately until the end of October. I am not too encouraged by the so-called contingency plans. How could they possibly prevent oil from occurring in many areas as the currents move along the coast of the Beaufort Sea? I will not try to reconstruct the scenario of an oil spill. It is rather grim reading. I am sure it will be presented at this inquiry at another time. The only thing that probably can be done is to pinpoint the places and time where most birds can be expected to occur and thus try to avoid drilling and construction activities at these times and places. This is a difficult thing to do because no two years are the same. 1974 the year of the so-called Beaufort Sea Studies, was one of the poorest ice years on record. The only two years I know of from my experience that were worse was the year 1959 and the year 1964. A year like 1973, which was a very light-ice year, would create a whole different distribution pattern of waterfowl and a whole different set of logistical problems for the drillers and the construction people. I find it difficult to try to predict an impact of something that we have little control over, namely, the weather and the ice. The whole question to environmental impact and environmental impact assessment, environmental monitoring disturbs me considerably. I find it difficult to see how an unknown situation can be predicted. An environmental impact is what people are trying to predict might happen in the future, and hence ways to alleviate it. It baffles me. I think to monitor an environmental problem is not curing anything. It is just documenting for historical purposes what has actually happened. In the area of the Beaufort Sea, to me, it is complete specul-

ation of what might happen and how things occur.

The knowledge of wave action and ice action has been determined on the basis of very limited years of experience and I think it would be extremely difficult to make any prediction as to what might happen, and from there to try to predict an impact of what would result. If there is a time when there are big waves and there happens to be a blowout, which direction will the oil spread? These are guessed at in some of the oil spill scenarios. But it is a disturbing thing to me. To me an impact statement should be related to some historical events. There are many historical events to which analogies can be drawn, at least on the land operation of the pipeline. I shall now consider the cross-Delta route and the route along the north slope, on which I think some remarks should be made at this time.

As I mentioned before, the low flat islands of the Mackenzie Delta, are subjected to storm tides and possible deposition of oil or any other contaminants over large areas, which in turn would probably affect the plant life of the Delta. The Delta is important for snow geese nesting in the Kendall Island Bird Sanctuary. It is also an important area for whistling swans; probably one of the most dense nesting areas in North America. There are parts of the Delta which are extremely important to white-fronted geese, many varieties of waterfowl, pintails, mallards, scuap ducks, old squaws, and sandhill cranes and shore birds. The Mackenzie Delta lowlands and I include the areas all the way from Richards Island to the Blow River, mouth of the Blow River, is very important fall staging area,

as I mentioned, for geese coming into the Delta. It is one of their first stopping points before they disburse along the coast and the north slope. It is one of the last places to get snow cover. It is a point of departure southward in the fall for many of these birds. In a good year, after Banks Island or Anderson River, or Kendall Island, has had fairly high reproduction; all the snow geese arrive into the Mackenzie Delta's outer islands, with many young with them. Their population can go as nigh as 400 to 500,000 birds. The impact of the pipeline through that outer delta's prime nesting grounds and prime feeding and staging and moulting areas is going to be difficult.

There are some historical impacts that we should look at to try to draw analogies. I think this is probably safer to do than to speculate on what might happen as in the Beaufort Sea problem. The proponents state that the pumping stations along the pipeline route will be spaced 50 miles apart, with an air strip. Some years ago and starting in 1955, the Distant early warning (DEW-line) sites were constructed coincidentally every fifty miles apart and built at a time when there was little concern for environmental damage. The DEW-line sites were built with tremendous aircraft, land and sea support. The construction of the DEW-line sites involved aircraft in numbers larger than the Berlin Airlift. There is a lot of similarity between the Dew-line sites and what the proponents say the pumping stations will be. I cannot for the life of me figure out why they have not done historical studies of what impact the Dew-line had on the flora and fauna along the route. Furthermore, I find it quite difficult to understand why the Dew-line sites are not themselves used. Why not use the site that

has already disturbed the countryside. The way the route is planned, at least along the north slope, which is also a very critical area, it is doubling the amount of disturbance of the environment, at least as far as the pumping stations are concerned. The proponents should demonstrate why existing Dew-line sites could not also be used. Dew-line sites are recognized to be obsolete so why shouldn't the line be constructed to connect between the various sites. Now, crossing the Delta, I notice that they have chosen some of the prime and best waterfowl habitats. The proposed line crosses the Moose Channel Flats in the area of Coal Mine Lake and Moose Channel, crosses Shallow Bay to Ellice Island area which is one of the most concentrated areas for staging geese, and also very important for nesting swans, cranes and ducks. In the middle of that area another compressor station is planned. I cannot personally see why they don't put the compressor station back on the mainland, into the hills, or at Shingle Point, where there is already a Dew-line station. Tununik, which is another ex-Dew-line station is approximately 50 miles from Shingle Point. Why do they have to put a compressor station in the middle of the Delta?

Some years ago I participated in a study done for the Arctic Petroleum Producers' Association and financed at least in part by Imperial Oil, on the affects of oilwell drilling on wildlife. This was at the original Taglu discovery site located on the boundary of Kendall Island Bird Sanctuary. In that study, we found noise levels of over 100 decibals, especially when they were fishing and doing the

various things they do when drills get stuck and all that. They had frequent helicopter arrival and departures, although I must stress that Imperial Oil followed a prescribed helicopter route to and from the site because of its environmental sensitivity. The site appeared to have as much activity around it as would a compressor station in its construction and operational phase. We had study plots studying the nesting densities of birds around that site. The plots were in a 1-1/2 mile radius around the site. We had a control area behind some hills, on Richards Island, which was similar terrain. We found that as far as nesting birds were concerned, approximately 50% of them were disturbed enough to have moved out of the area. There was another approximately 50% that seemed undisturbed. There were some that nested in traditional nesting sites - e.g. swans, they had nested there for many generations before the drill rigs suddenly appeared there. One was only a quarter of a mile from the rig but as soon as the young hatched, they took the young considerable distances from the area. I had worked in that area for about 3 or 4 seasons before the Taglu drill was put in, so we had some fairly good background information on the movements of flightless geese and broods fo geese. The most seriously affected were whitefronted geese, which evacuated the area up to 10 miles away. Snow geese stayed farther out on the periphery on the outer edge of the Mackenzie Delta and swans did not use the channels where we had found many broods in prior years. The general impact on the area was of course variable with each species. Some were actually attracted to the site. Drilling mud and pallets provided nesting cover for snow buntings which had not been found nesting in that part of the country at all

before. The rig site attracted ravens, even though the company did keep a very clean and tidy camp and burned and incinerated their garbage. Other species were of course not disturbed for or against. From studies done by consulting firms and by outselves at Anderson River and at Kendall Island Bird Sanctuary, have shown that geese, especially flying geese, will move and are disturbed by noise of equipment and by helicopter and aircraft. At varying times during the year some will disburse at distances of up to five or so miles from the source of the disturbance. I think we can relate what happened at Taglu to what would happen with a compressor station located at the north side of Shallow Bay. I think we can draw some firm conclusions on the basis of a historical record of what happened before. This, I think, is an impact where we are not speculating. We are able to be fairly sure of what might occur. I would suggest that an area of around five to 10 miles depending on how well aircraft are controlled, that compressor site, will not be used at all by any staging geese. As I mentioned before, anywhere from 200,000 to 500,000 birds can be found in that area during the latter part of August through the month of September and in some years until October. I think these types of questions the proponents should investigate.

Historically the Mackenzie Valley pipeline, as proposed, will not be the first one to be built in the North. The Canol Pipeline was built during the rush of the war years. It was built with no regard whatsoever for the environmental effects. Its history is quite well known. There were at least 22,000 people involved in the construction of the Canol Pipeline. What historical and present-day impacts are evident from that operation? I think some good

analogies can be drawn, although it would be difficult to do. There are parts of the village of Canol opposite Norman Wells which I have visited. It was quite ironic to find a Utilidor like the one that threads through Inuvik. It is now completely covered with aspen and spruce trees and the impact, is something that can be thoroughly documented. I bring these points up because I think there are some distinctions between historical impact and guesswork impact that this inquiry should make.

The construction and operation of the Taglu Gas processing Plant, is located right close to the Taglu wellsite which we studied earlier. I can assume, without having all the information as to the size and the noise levels and so on of that plant that it will probably have an impact somewhat similar to the Taglu drillsite. In other words, it will affect some species within a certain radius of the place. It will affect the movements of other species and is in an area that has already been disturbed, there are at least 4 or 5 wells around that site. But I question why the gas plants (Shell and Imperial) cannot be located in less sensitive areas - such as Tununik on Richards Island.

CURRICULUM VITAE

Dr. Thomas W. Barry

I worked with Canadian Wildlife Service as a Research Scientist. My special area of interest has been the Waterfowl of the Western Arctic. I have been with the Wildlife Service for nineteen years.

I was born in Rochester, New York and raised and went through the Rochester School System. When I finished Grade XII, I enlisted in the United States Navy-Airforce and served a four-year term. When the War was over, I attended the University of Rochester and obtained a Bachelor of Arts Degree in 1948. I then went to Syracuse University, where I obtained a Law Degree in 1951. I practised law in New York, for 3 years and worked in industrial and labor relations for General Motors Company.

In 1953 I saw the light and having made a trip to the Arctic to Southampton Island, I returned to University and started all over again. At Cornell University, I eventually attained a Master of Science Degree, majoring in Wildlife Management and Animal Physiology.

In 1957 I joined the Canadian Wildlife Service as a Western Arctic Ornithologist. As a result of work done with the Wildlife Service, I entered the University of Alberta and obtained a Ph.D. Degree in Zoology in 1967.

I worked in the Eastern Arctic, on Southampton Island for 3 seasons and in the Mackenzie Valley 1958. I worked at the Anderson River Delta and across the Arctic Coast since that time. I lived in Inuvik for about six and one-half years and am now stationed in the Edmonton Offices of the Canadian Wildlife Service.

In my Arctic experience I was primarily concerned with waterfowl. I have been involved in several projects which may be of relevance to this inquiry. In 1958 and in 1960, I conducted reconnaissance surveys for the purpose of delineating Migratory Bird Sanctuaries across the Arctic. I had previously worked on the description and requirements of Migratory Bird Sanctuaries around the Hudson's Bay. These were established in 1958. After the summer of 1960, I spent the winter of 1960-1961 in Ottawa. Fortunately at that time I was able to follow through the descriptions of these Western Arctic Bird Sanctuaries. They were eventually established by Order-in-Council in 1961. These Bird Sanctuaries, in which I was directly involved from the initial surveys, to the final establishment are: the Kendall Island Migratory Bird Sanctuary, the Anderson River Delta Migratory Bird Sanctuary, the Cape Parry Migratory Bird Sanctuary, the two Bird Sanctuaries on Banks Island, one encompassing the large nesting grounds of the snowgeese on southwestern Banks Island, and a very important moulting area on the north Banks Island. Further east, the Queen Maude Gulf Migratory Bird

Sanctuary covering a very large area from the Ellice River to Sherman Inlet. This Bird Sanctuary is designed for quite a few species of geese and is one of the largest ones in the world. I participated earlier in establishing the Harry Gibbons Bird Sanctuary on the Bay of God's Mercy on Southampton Island and the East Bay Sanctuary on the east side of Southampton Island and the McConnell River Sanctuary north of Churchill on the west side of Hudson's Bay.

I participated in the studies of the Taglu Drilling Rig and its effect on Wildlife done in 1971-1972 and with a Native of Sachs Harbour, Mary Carpenter, conducted a study in 1967-1968 involving the economic and cultural values of Wildlife to the Indians and Eskimos of the Mackenzie Delta region. I had the role of coordinating the Sea-bird Section of the Beaufort Sea Studies done in 1974-1975. This is the basis of much of this report. The work was done mainly by consultant firms. Some of these firms are also involved in other capacities, by the proponents. Both Renewable Resources Consulting Services and LGL Ltd. are consultants for the proponents and they have done some work for us in the Beaufort Seas Studies. Also the source of the information for the Beaufort Sea Studies are from Wildlife Service staff, including myself and Mr. Ernie Kuyte from Fort Smith.

I also participated in studies of the economic and cultural values of wildlife in the Bathurst Peninsula to the residents of Tuk.

This report was done in connection with the moratorium on seismic activities on Bathurst Peninsula. The report was done for the Minister of the Department of Indian and Northern Affairs and I am not sure whether that report has been released yet. It was done a couple of years ago. I also participated in a study along a similar line of the wildlife values, especially white fox, geese, musk ox, caribou and so forth on Banks Island. I assisted in the design and write-up of this report, again done for the Minister of the department of Indian and Northern Affairs, and relating to seismic activities on Banks Island. Again, I am not sure if this report has been released by the Department of Indian and Northern Affairs.

Further to some points I mentioned before about the various consultants for the Proponent. In the reports of LGL in particular for the proponent, I am flattered to note that I have been acknowledged in the assistance and design of the various studies that they have done. I didn't participate in the actual studies but consulted with the consultants, if you wish, in their design and methods.

During the period 1964-1974, I operated a boat along the Arctic Coast. It was a 32-foot, twin engine twin diesel engine boat, which we used in our work. Having echo sounders and things like that on board, gave me a very thorough knowledge of the various river channels, the depths, the shorelines and

harbors, for the area between Cape Parry on the east and Herschel Island on the west and the Mackenzie Delta and Liverpool Bay. This information has been valuable for our own work, but we have on frequent occasions supplied information that has been helpful to the oil companies and river transport companies on depth of channels, areas and methods of getting equipment into spots thought to be inaccessable by water. It has been quite useful, I think, in reducing overland travel.

I think I should point out in closing that during my 19 years of work in the Western Arctic, we have employed quite a variety of people. Most of our work is in the bush camps, not in town. I have hired Natives every season. In most instances, I have hired people with reputations as good bush trappers and travellers, as opposed to people working in the various towns around this area. One person has worked for me for the last 13 years and is as reliable and competent a person as I have ever worked with.